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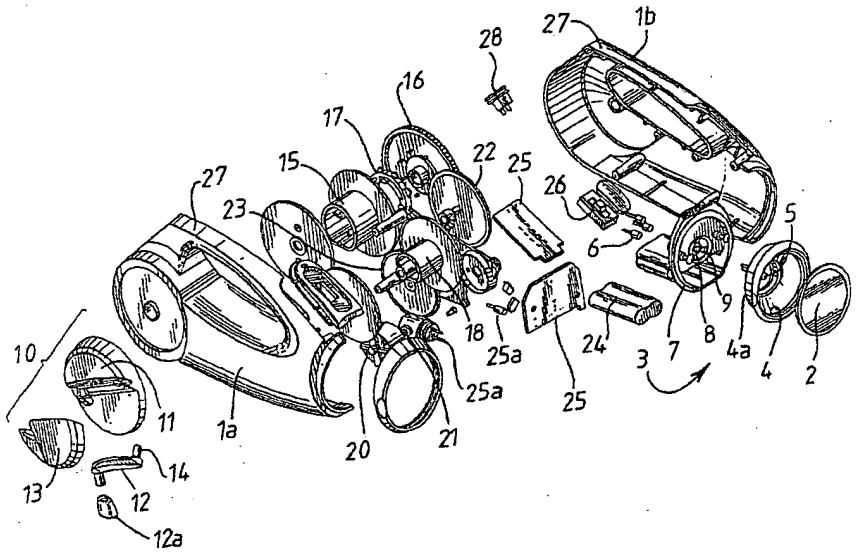
(54) Title: ELECTRIC TORCH



(57) Abstract: There is described an electric torch (1) having a first, higher-power, light source (5) operable by means of a battery (24), and a second, lower-power, light source (6) operable by a rewindable spring-powered mechanism driving an electrical generator (20) via a transmission. The transmission includes a one-way coupling (17) which prevents transmission of torque to the generator while the mechanism is being wound up. The torch includes switching means (26) and circuitry (25) arranged so that the generator is short-circuited when the torch is turned "off" or when power is supplied to the first light source from the battery. The battery is preferably rechargeable, by means of an input socket (28) provided on the torch body (1).

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Electric torch

The present invention concerns electric torches, and is particularly concerned with an electric torch having alternative power sources. More particularly, the present invention concerns and electric torch operable either by means of a spring-powered generator or by means of a rechargeable or replaceable battery.

An electric torch powered by a spring-operated generator is known from co-pending UK patent application No. 9726478.2, which application describes an electric torch wherein a filament bulb is powered by a rechargeable battery pack and a spring-operated generator is connectable to provide power to charge the battery pack. Circuitry is also provided for charging the battery from an external power source.

Hand-held torches or lanterns are conventionally fitted with incandescent filament bulbs. If such a bulb is to be operated to give a white or near-white light at a low power consumption, the filament of the bulb needs to be reduced in thickness to the point at which the bulb becomes too fragile for use in a hand-held lantern. If the filament of the bulb is made sufficiently robust to withstand normal use, then a substantial current, typically of the order of 0.5 to 1 A at 2.4V, must be provided to a filament bulb in order to achieve an

acceptable level of light from the bulb.

The total amount of power which can be produced by a spring-operated mechanism during a complete cycle of winding and unwinding of the spring is governed by the amount of energy which can be stored in the spring during winding. To enable a spring-powered generator to produce a substantial electrical current for a prolonged period, the spring must be of heavy construction. However, in order to provide a spring-powered electric torch which is sufficiently small to be readily portable, the dimensions of the spring which powers the generator must be made small, and the power output of the generator is correspondingly reduced. Consequently, if the generator is small enough to be readily portable, it is unable to provide sufficient current to operate a robust filament bulb at an acceptable level of brightness for a sufficient period.

In the prior art arrangement, the filament bulb is powered either by the battery, or by the spring-powered generator. The power output of the generator is however only sufficient to light the bulb for about three minutes before the spring winds down. When the battery is discharged, the operator must rewind the torch at such short intervals that it is impractical to use.

An objective of the present invention is to provide a

torch capable of supplying an acceptable level of illumination for a prolonged period.

A further objective of the present invention is to provide an electric torch which can be operated without the need for external power supplies.

A further objective of the present invention is to provide a torch, operable by means of a spring-powered generator, which is of simple construction in both its mechanical components and its electrical circuitry.

According to an aspect of the present invention, there is provided an electric torch, comprising a light unit having a first light source and a second light source of lower power output than the first light source, battery means for providing power to the first light source, a generator for providing power to the second light source, a spring-operated mechanism for driving the generator, and switch means for selectively a) isolating the first and second light sources from their respective power supplies, b) connecting the battery to the first light source, or c) connecting the generator to the second light source.

Preferably, the first light source is an incandescent filament bulb and the second light source is a number of LEDs.

In an alternative embodiment, the light unit comprises a plurality of LEDs, and the first light source is constituted by a first number of LEDs selected from the said plurality, and the second light source is constituted by a second number of LEDs selected from the said plurality.

In the preferred embodiment, the battery means comprises a rechargeable battery. Most preferably the torch further comprises input means for supplying charging current to the battery.

Other aspects of the invention will become clear from the following description.

Embodiments and features of the present invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an electric torch seen from the front and from one side;

Figure 2 is a perspective view of the torch of figure 1, seen from the rear and from the other side;

Figure 3 is an exploded perspective view of the torch of figures 1 and 2;

Figure 4 is a circuit diagram of the electrical components of the torch of figures 1 to 3;

Figure 5 is a schematic diagram showing the operation of a generator powered by a spring;

Figure 6 is a schematic illustration showing an arrangement of a spring for powering a generator; and

Figures 7 and 8 show alternative drive trains for transmitting torque from a spring to a generator.

Referring now to figures 1 to 3, there is seen an electric torch comprising a main body 1 formed of two half-shells 1a and 1b. At the front end of the body 1 there is positioned a lens 2 through which light from a light unit 3 may pass. The light unit 3 comprises a reflector 4, an incandescent filament bulb 5, and 3 LEDs 6 arranged in a triangular array round the bulb 5. A backplate 7 has a central opening 8 to accept the bulb 5, and three spaced openings 9 each to accept a respective LED. The reflector 4 is received in a holder 4a which is removably mounted to the back plate 7, and the lens 2 is mounted to the reflector 4.

At the rear end of the body 1 a winding handle assembly 10 mounted to the body so as to be rotatable about a first axis transverse to the body. The winding handle

assembly 10 comprises a disc 11 to which a crank arm 12 is pivotally connected, and a cover piece 13. The crank arm 12 is attached to the disc 11 by means of a pivot pin 14 which extends substantially tangentially of the disc 11, so that the crank arm 12 can be moved from a folded position in which the crank arm 12 extends diametrally across the disc 11, to an extended position in which the crank arm 12 extends substantially radially outwardly from the disc 11. The disc 11 and cover piece 13 are fixed together so as to define a substantially diametrally extending slot into which the crank arm 12 is received when in its folded position. A grip 12a is rotatably mounted at the free end of the crank arm 12, so as to rotate about and axis substantially parallel to the said first axis when the crank arm 12 is in its extended position.

A first spool 15 is attached to the disc 11, and is supported within the body 1 for rotation about the first transverse axis. A first gear 16 is also rotatably mounted coaxially with the first spool 15, and a one-way coupling or ratchet mechanism 17 is operable to transmit torque from the first spool 15 to the first gear 16 when the first spool 15 is rotated in one direction, but allows the first spool 15 to rotate in the opposite direction without transmitting that rotation to the first gear 16.

A second spool 18 is mounted in the body for rotation about an axis substantially parallel to that of the first spool 15. A resilient strip 19 (not shown in figure 3, but illustrated schematically in figure 6) is wound in spiral fashion round the second spool 18, with its radially inner end fixed to the second spool 18. The radially outer end of the resilient strip is fixed to the first spool 15. The resilient strip 19 extends from the first spool 15 and crosses a plane containing the axes of the first and second spools 15 and 18 before winding round the second spool 18, for reasons which will be described in detail below.

Torque transmitted from the first spool 15 to the first gear 16 is then transmitted to first intermediate gear 22, which meshes with a second intermediate gear 23, and the drive is finally transmitted to a pinion 21 on a generator 20. The drive train is shown schematically in figure 7. A similar arrangement is shown schematically in figure 5, wherein it can be seen that the large diameter first gear 16 meshes with a small-diameter part 22a of the intermediate gear 22, while the pinion 21 of the generator 20 meshes with a large-diameter part 22b of the intermediate gear 22. The transmission thus provides an increased rotation speed for the generator 20 as compared to the rotation speed of the first spool 15. It is clear from figures 5 and 7 that the torque may be transmitted from the spool 15 to the generator 20 by a

transmission having 3 or 4 gears, and it will be understood that any number of gears may be used to achieve the necessary rotation speed and torque at the generator 20.

The operation of the electrical generator is as follows:

In the starting position, with the spring mechanism "unwound", the resilient strip 19 is coiled on the second spool 18. The crank arm 12 is pivoted out from the disc 11, and used to rotate the disc 11 so as to rotate the first spool 15 in a first rotation direction, the sense of which is to draw the resilient strip 19 from the second spool 18 and wind it round the first spool 15. This rotation direction is indicated by the arrow A (the "winding direction") in figure 6. The ratchet 17 is so arranged that, when the first spool 15 is rotated in the winding direction, no torque is transferred to the first gear 16. Rotation of the disc 11 is continued until the resilient strip 19 is substantially completely transferred from the second spool 18 to the first spool 15.

As will be clear from figure 6, the curvature of the resilient strip 19 when wound about the second spool 18 is in the opposite sense from the curvature of the resilient strip 19 when wound about the first spool 15. This reversal of the curvature of the resilient strip

builds up internal stress in the resilient strip 19, and in seeking to return to its initial low-stress condition the resilient strip 19 tends to uncurl from the first spool 15, and curl round the second spool 18. This has the effect of applying a torque to the first spool in a sense opposite to the winding direction.

When the crank arm 12 is released, the first spool 15 and the disc 11 will be urged to rotate in the direction opposite to the winding direction, and the ratchet 17 will transfer this torque to the first gear 16. The torque is transmitted from the first gear 16 to the first intermediate gear 22, and thence to second intermediate gear 23 which in turn applies the torque to the pinion 21 of generator 20. It will be understood from the figures that the gear ratios between the first and intermediate gears 6 and 22, and between the intermediate gears 22 and 23 and between gear 23 and the pinion 21 cause a smaller torque to be applied to the generator, but with a greatly increased rotation speed as compared to that of the first spool 15.

The resilient strip 19 will gradually be transferred back from the first spool 15 onto the second spool 18, rotating the generator against a resistance which depends on the electrical load of the generator. When the resilient strip 19 has returned to the second spool 18, rotation of the generator will cease. If further power

is required, the mechanism must then be rewound.

Mounted within the body 1 are a rechargeable battery 24, printed circuit boards 25 carrying the electrical components of the torch (shown schematically in figure 3, and indicated by reference 25a), and a three-position switch 26. These components will be described in detail below.

At an upper part of the body 1, a handle 27 is formed to extend longitudinally of the body. At the front end of the handle 27, the switch 26 is provided to control the operation of the torch. In figure 1, the switch 26 is shown in its central position. In the rearmost position of the switch 26, the torch is "off". In the central position of the switch 26 the filament bulb 5 is illuminated, and in the forwardmost position the LEDs 6 are illuminated.

At the rear end of the handle 27 there is provided a socket 28 for connection to an external power source for charging the battery 24. An indicator light 29, which may be an LED, is provided adjacent the switch 26, to indicate when charging from an external source is in progress.

On the underside of the body, a pair of transversely-extending "feet" ensure that the torch can be firmly

supported on a horizontal surface. Other surfaces of the body may also be formed with flattened areas, or with projecting feet, to enable the torch to be stably supported in other orientations.

The electrical circuits of the torch are shown schematically in figure 4. In the Figure, the external power charging circuitry is indicated at 30, and comprises the socket 28, a diode 31, resistors 32 and 33 connected in parallel, and light-emitting diode (LED) 29 connected in series with resistor 33.

When an external power source of the correct voltage and polarity is connected to socket 28, current flows through the diode 31 and is divided between the resistors 32 and 33 via LED 29 before passing to the positive terminal of the battery 23. The LED 29 is protected from overcurrent by the resistor 32, and lights up when the battery 24 is being charged. The negative terminal of the battery pack 23 is connected to the socket 28 via ground line 34.

The three-position switch 26 is a two-gang switch with eight poles numbered in the diagram from 0 to 7. The connections of the poles are as follows:

0 is connected to the negative battery terminal and to the ground line 34;

1 is connected to terminal S1 of the bulb holder, via a low-voltage protection circuit 35 (to be described

later);

2 is connected to the positive battery terminal;

3 is unconnected;

4 is connected to the respective low-voltage terminals of three current-limiting resistors 36, each of which is connected to a respective one of the LEDs 6;

5 is connected to the negative output terminal of the generator 20;

6 is connected to the positive output terminal of the generator 20, and to the positive terminals of the three LEDs 6; and

7 is connected to the negative output terminal of the generator 20.

In an alternative embodiment (not illustrated) switch poles 5 and 7 may be connected together, and only one of poles 5 or 7 need then be connected to the negative terminal of the generator.

In the rearmost switch position, illustrated in figure 4, contact is made between switch poles 6 and 7, to short-circuit the generator. Contact is also made between switch poles 0 and 1, to connect the positive terminal of battery 24 to terminal S1 of the bulb holder. The negative battery terminal is connected permanently to ground line 34, and to terminal S2 of the bulb holder. If the spring is under tension, it unwinds and drives the generator 20 to cause current to flow round the short-

circuit, providing a mechanical resistance which prevents the mechanism from unwinding rapidly.

In the central switch position, illustrated in figure 1, contact is made between switch poles 1 and 2, and between switch poles 6 and 5. The contact between switch poles 6 and 5 short-circuits the generator 20, and the contact between switch poles 1 and 2 connects the positive terminal of battery 24 to terminal S1 of the bulb holder via the low-voltage protection circuit 35. Since terminal S2 of the bulb holder is permanently connected to ground (earth) and to the negative battery terminal, the bulb 5 is illuminated by power from the battery 24. The bulb filament controls the amount of current, and determines the endurance of the torch when operated on battery power. The short-circuit of the generator 20 has the same effect as before, limiting the rate at which the mechanism unwinds if any tension remains in the spring.

In the forwardmost switch position, contact is made between switch poles 2 and 3, and between switch poles 5 and 4. The negative generator terminal is connected via switch poles 5 and 4 to the current-limiting resistors 36, which are respectively connected to the negative terminals of the LEDs 6. The positive generator terminal is connected permanently to the positive terminals of the LEDs 6, and thus in the forwardmost position of the switch 26, rotation of the generator 20 causes current to

flow through the LEDs 6. Capacitor 53 is included to prevent flickering of the LEDs by smoothing the generator output. The positive battery terminal is isolated since no connection is made to switch pole 3, and thus the bulb 5 is not illuminated. The generator 20 is designed to produce an output of from approximately 30 to approximately 100 mA at between 2 and 4 Volts, preferably at approximately 3.6 Volts.

Markings on the body of the torch adjacent the switch indicate to the operator the mode of operation of the torch in each switch position. In the illustrated embodiment seen in figure 1, the rearmost position is signified by a "0", the central position by a schematic illustration of a battery, and the forwardmost position by a circular arrow, signifying "wind up" operation.

The low-voltage protection circuit 35 comprises a transistor 37 functioning as a switch to control the flow of current to the bulb 5 from the battery 23. The base of transistor 37 is connected to ground via a resistor 38 and a control transistor 39, whose base is fed by a voltage-sensing circuit comprising resistors 40, 41 and 42, and capacitor 43. When the battery voltage drops to a predetermined level set by selecting the resistances of the resistors 40, and 41, the control transistor 39 changes state and the transistor 37 "turns off". This prevents further current from being drained from the

battery, and prevents damage to the battery caused by over-discharging.

Between uses, the torch is intended to be connected to an external power source via the socket 28 with the switch 26 set to the rearmost position, in order to maintain a full charge in the battery 24. The values of the resistors 32 and 33 are chosen so as to limit the charging current to a level which will not cause damage to the battery 24.

When the torch is required to be operated, the operator first chooses whether a brighter or a less bright light is required. If the brighter light is required, the external power source is disconnected and the switch 26 is moved to the central position, connecting the battery to the filament bulb 5, through the low-voltage protection circuit 35. The bulb 5 is illuminated, and the battery gradually discharges until the threshold voltage is reached and the transistor 37 switches off the bulb 5. The endurance of the torch in this mode depends on the capacity of the battery pack, and the rate at which current flows through the filament bulb 5. Preferably the battery pack is designed with a storage capacity of 650 mA.hr and a voltage of 2.4 volts when fully charged, and the bulb filament has a resistance of from approximately 2 to 5 Ohms.

If a less bright light is sufficient for the operator's needs, the operator uses the crank arm 12 to wind the spring-operated generator. The operator then moves the switch 26 to its forwardmost position, and the spring mechanism gradually unwinds and drives the generator 20, causing the LEDs 6 to be illuminated. If the mechanism unwinds before the operator has finished his task, he can simply re-wind the mechanism to prolong illumination of the torch. When the task is finished, the operator returns the switch 26 to its rearmost position, short-circuiting the generator terminals. This short-circuit increases the resistance to turning of the generator, and limits the speed at which the spring-operated mechanism will wind down.

If, during the operator's task, a brighter light is required then the operator can move the switch 26 from its forwardmost position, in which the LEDs are illuminated, to its central position in which the LEDs are extinguished. The generator is again short-circuited, slowing down the rate at which the spring-operated mechanism will wind down. Simultaneously, the battery 24 is connected to the bulb 5 to illuminate the bulb. When the need for brighter light is passed, the operator can return to the generator-powered LED lights by returning the switch 26 to its forward position. The remaining tension in the spring will then power the generator until the spring is fully unwound.

By controlling the unwinding of the spring mechanism solely on the basis of the electrical loads on the generator, the mechanism of the torch is simplified in that no mechanical brake is required for the spring-operated mechanism. In the embodiment described, the endurance of the torch is approximately 10 minutes when operated from the fully-wound condition with the LEDs 6 illuminated. When the switch 26 is so positioned as to short-circuit the generator 20, the spring mechanism will unwind from the fully-wound condition to the fully-unwound condition over approximately one hour. This controlled unwinding of the spring ensures that during any prolonged period of inoperation, the torch is stored with the spring in its relaxed condition, preserving its elastic properties.

In the above description, the spring-operated generator is used to power three LEDs which each draw a current of approximately 20 mA at a voltage of 3.3 to 3.6 V, while the battery is used to power an incandescent filament bulb drawing a current of from 0.5 to 1 A at approximately 2.4V. it is foreseen that the filament bulb may be replaced by a high-power LED, or an array of LEDs. In a further development, it is foreseen that a plurality of LEDs may be provided in the light unit 3, and the electrical circuitry of the torch may be such that when the battery power is used, all of the LEDs are illuminated and when the spring-operated generator is in

use then only selected ones of the LEDs are illuminated. The maximum power output of the spring-operated generator will determine the number of LEDs which can be supported by it.

In an alternative embodiment, not illustrated, the rechargeable battery 24, the connection socket 28 and the charging circuitry 30 are replaced by a battery holder for accommodating conventional non-rechargeable batteries, and an access opening is provided in the body for the removal of spent batteries and their replacement with fresh ones. The torch is thus operable using battery power to produce a bright light, or using power from the spring-operated generator to illuminate the LEDs if battery power is unavailable.

The drive transmissions illustrated schematically in figures 5 and 8 show alternative methods of transmitting power from the first spool 15 to the generator 20. In the arrangement shown in figure 5, a single intermediate gear 22 is interposed between the generator pinion 21 and the first gear 16. In contrast, figure 7 shows the assembled drive train of figure 3, in which two intermediate gears 22 and 23 are used to transmit torque from a first gear 16 to a generator pinion 21. The intermediate gears 22 and 49 each have a larger-diameter part and a small-diameter part, to provide a three-stage transmission.

In the transmission shown in figure 8, a first gear 16 meshes with the small-diameter part 22a of an intermediate gear 22, and the larger-diameter part of the intermediate gear meshes with a small gear fixed axially to a drive pulley 50. The generator is provided with a second pulley 51, and a drive belt 52 transmits the torque from the drive pulley 50 to the generator pulley 51. The drive belt may be a plain or toothed belt, or a "Vee" belt, or alternatively the pulleys may be replaced by sprockets and the drive belt by a chain. In a further alternative, the entire drive transmission may comprise a cascade of pulleys and drive belts.

Claims

1. An electric torch, comprising:

a light unit having a first light source and a second light source of lower power output than the first light source;

battery means for providing power to the first light source;

a generator for providing power to the second light source;

a spring-operated mechanism for driving the generator; and

switch means for selectively a) isolating the first and second light sources from their respective power supplies, b) connecting the battery to the first light source, or c) connecting the generator to the second light source.

2. An electric torch according to claim 1, wherein the switch means is arranged to short-circuit the generator when the generator is not connected to the second light source.

3. An electric torch according to claim 1 or claim 2, wherein the first light source is an incandescent filament bulb and the second light source is a number of LEDs.

4. An electric torch according to claim 1 or claim 2, wherein the light unit comprises a plurality of LEDs, and wherein the first light source is constituted by a first number of LEDs selected from the said plurality, and the second light source is constituted by a second number of LEDs selected from the said plurality.

5. An electric torch according to any of claims 1 to 4, wherein the battery means comprises a rechargeable battery and the torch further comprises input means for supplying charging current to the battery.

6. An electric torch according to claim 5, wherein the input means comprises a socket.

7. An electric torch according to claim 5 or claim 6, further comprising circuitry for preventing excessive charging current from being supplied to the battery.

8. An electric torch according to claim 5, claim 6 or claim 7, further comprising a low-voltage cut-out for preventing current being supplied from the battery to the first light source when the battery voltage falls below a predetermined threshold.

9. An electric torch according to any of claims 1 to 4, wherein the battery means comprises a battery holder for receiving a replaceable battery.

10. An electric torch according to any preceding claim, wherein the spring-powered mechanism comprises first and second substantially paraxial rotatable spools, and a resilient strip having its respective ends attached to respective ones of the spools, the resilient strip being movable, by rotation of the spools, between a relaxed condition in which the major part of the strip is coiled about the second spool and a stressed condition in which major part of the strip is coiled about the first spool.

11. An electric torch according to claim 10, wherein the curvature of the strip is reversed as the strip is moved from one coil to the other.

12. An electric torch according to claim 10 or claim 11, wherein the first spool is connected to the generator by means of a transmission including a one-way coupling, the arrangement being such that torque is transmitted from the first spool to the transmission only when the resilient strip is being wound from the first spool on to the second spool.

13. An electric torch according to any of claims 10 to 12, wherein the transmission comprises a gear train.

14. An electric torch according to any of claims 10 to 13, wherein the transmission includes a drive belt and pulleys.

15. An electric torch according to any of claims 10 to 14, wherein the transmission includes a chain and sprockets.

16. An electric torch according to any of claims 10 to 15, including a winding handle fixed to the first spool.

17. An electric torch according to claim 16, wherein the winding handle is substantially disc-shaped.

18. An electric torch according to claim 16 or claim 17, wherein the winding handle includes a pivoting crank arm movable between an extended position in which the crank arm extends substantially radially from the winding handle, and a retracted position in which the crank arm is received within a recess in the winding handle.

19. An electric torch substantially as described herein with reference to figures 1 to 3, figure 4, figure 5, figure 6, figure 7 or figure 8 of the accompanying drawings.

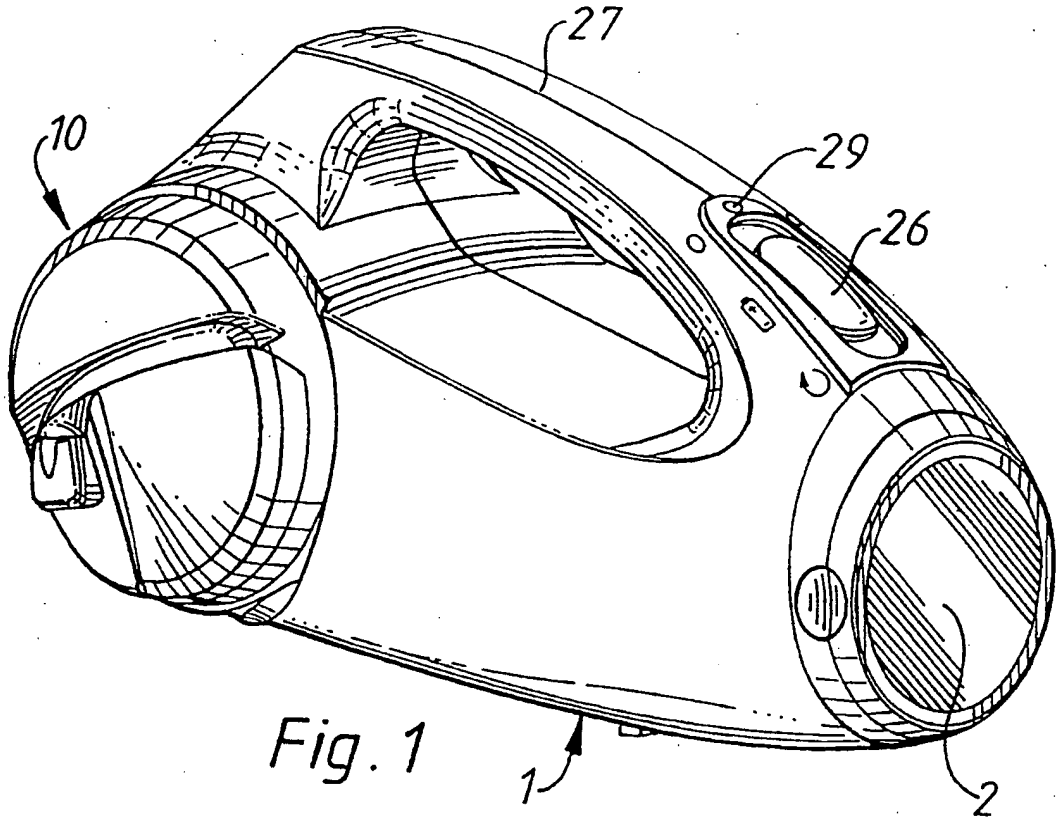

Fig. 1

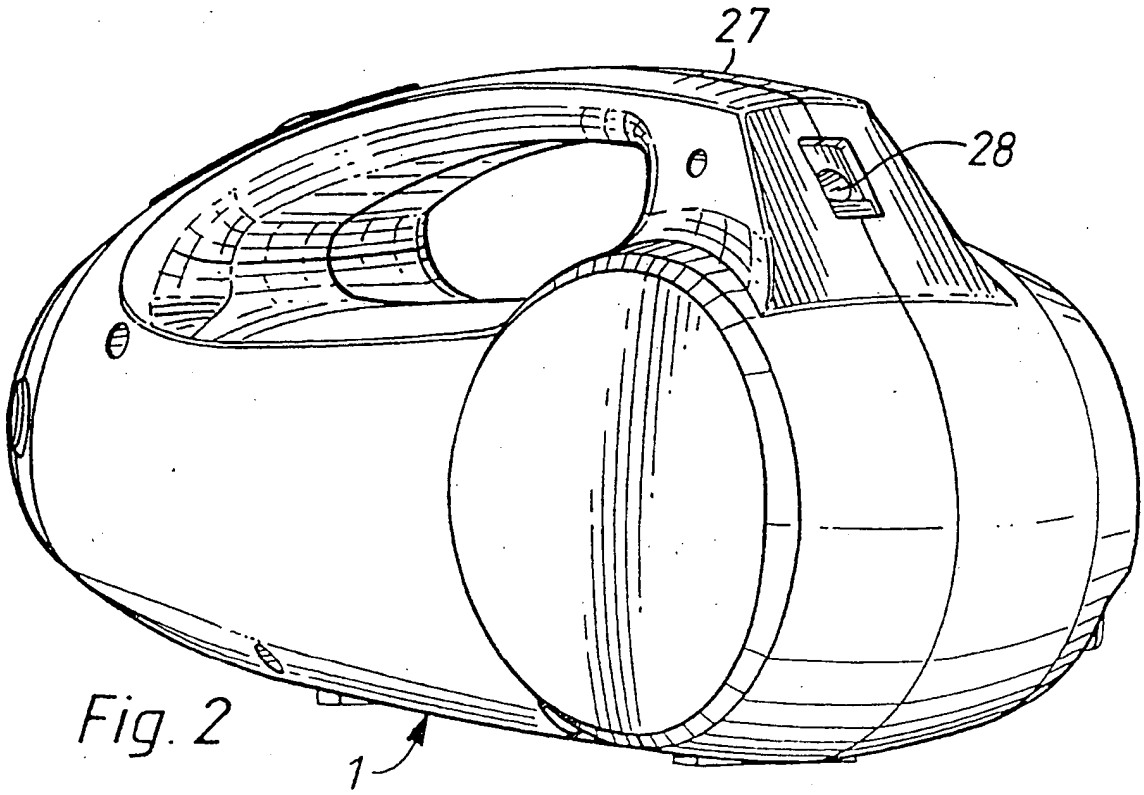

Fig. 2

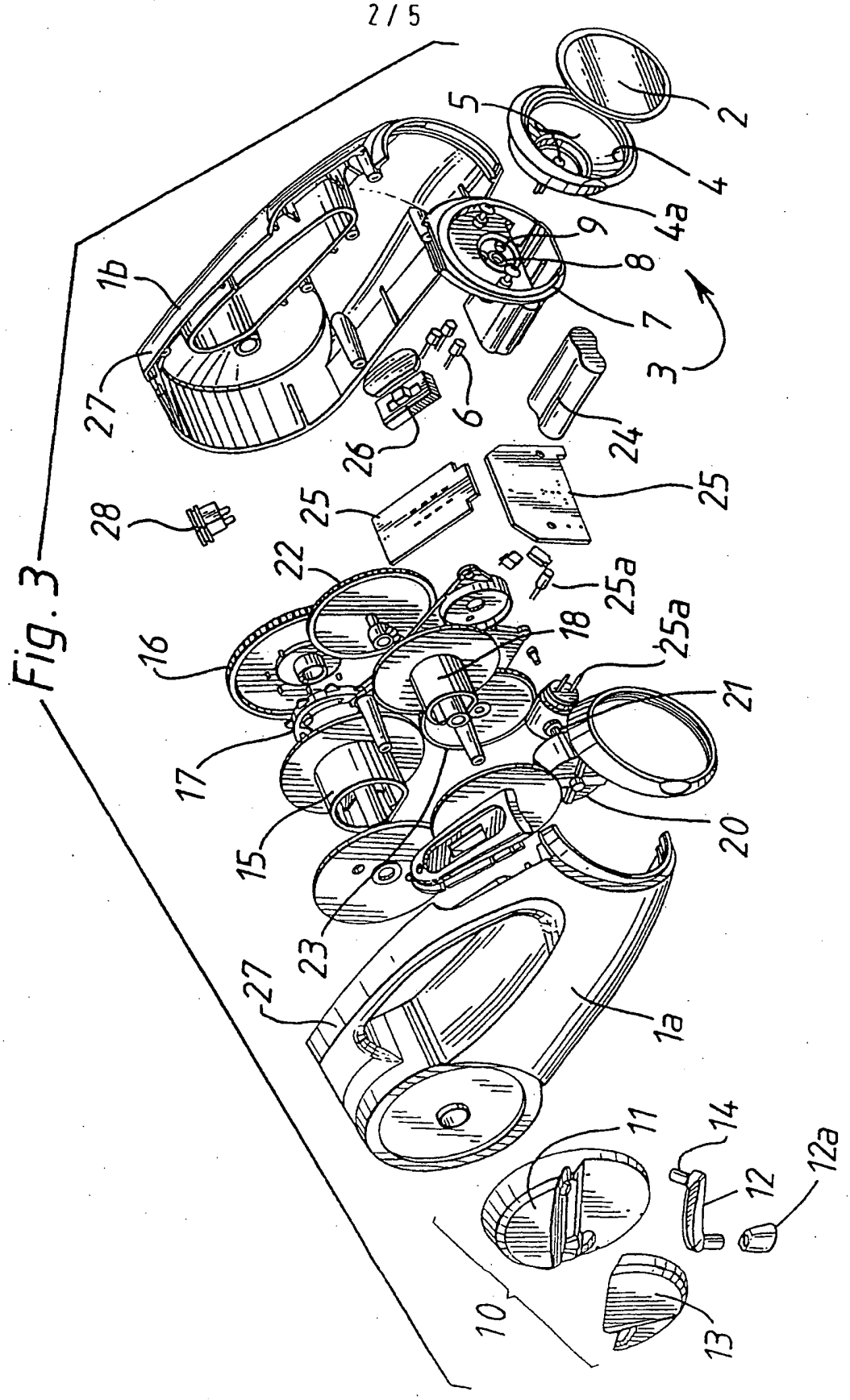
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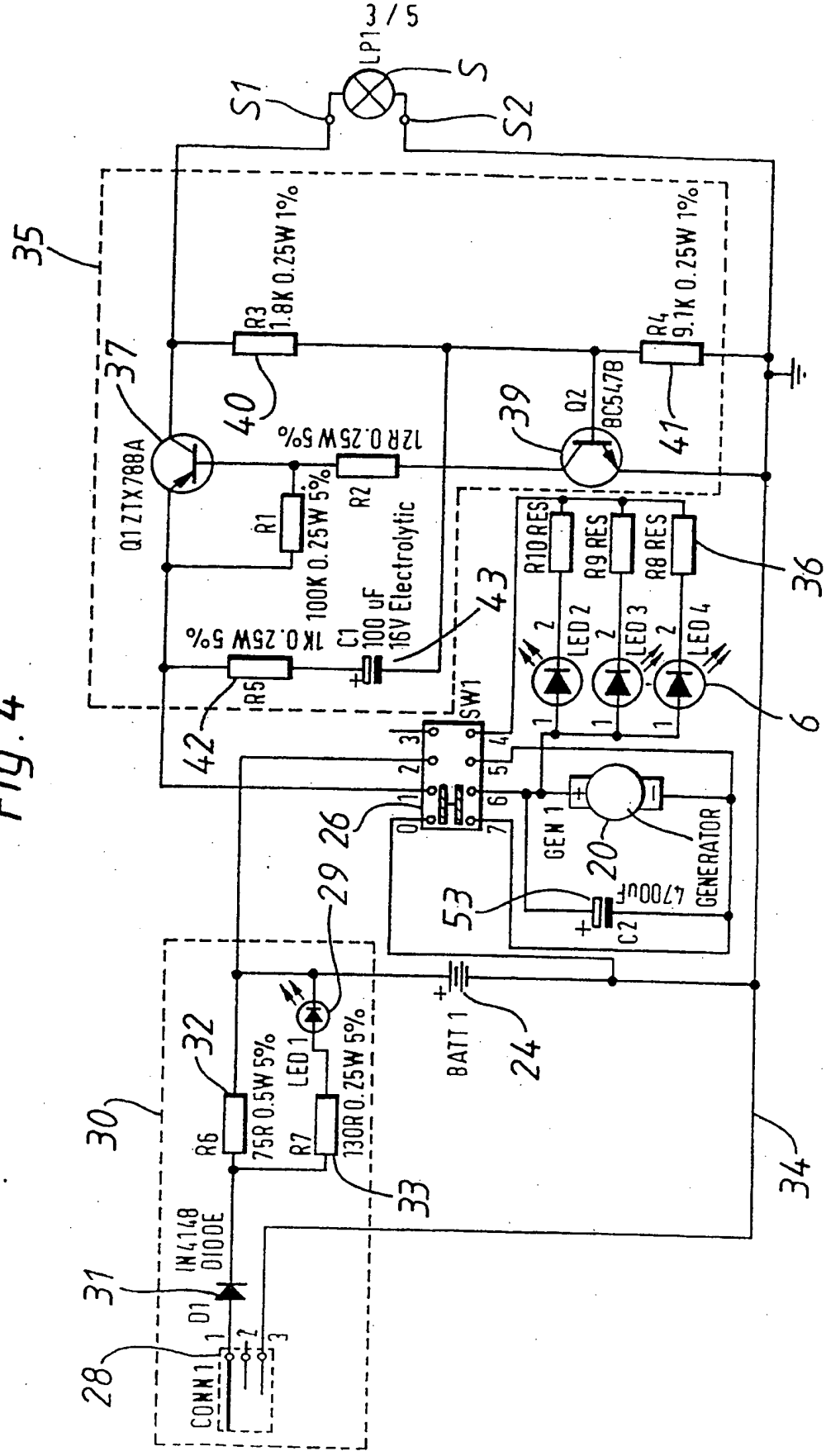
Fig. 3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R9 RES
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Fig. 4

Fig. 5

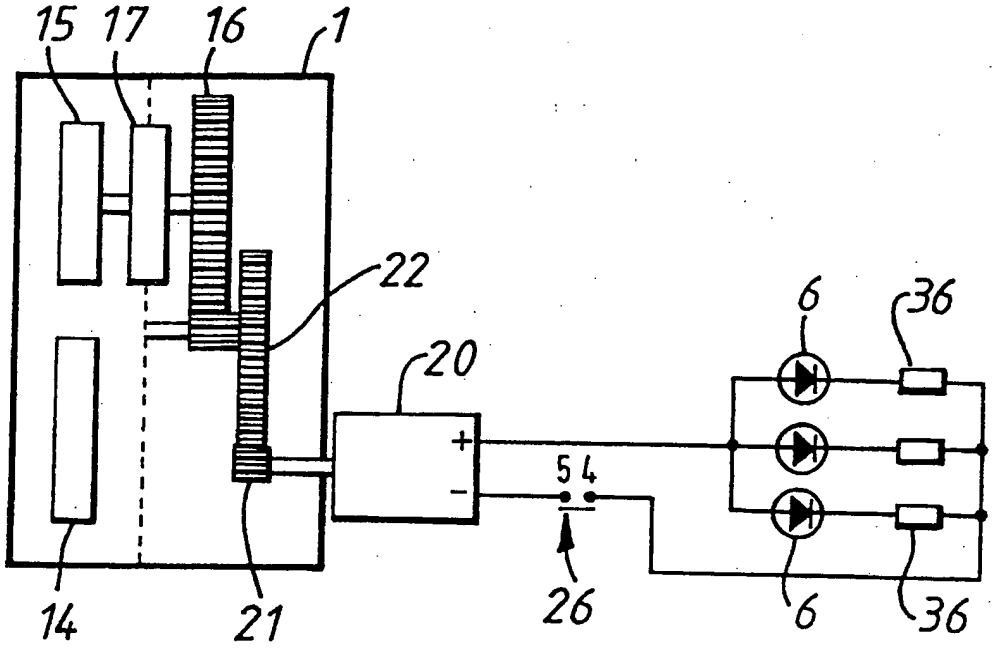


Fig. 6

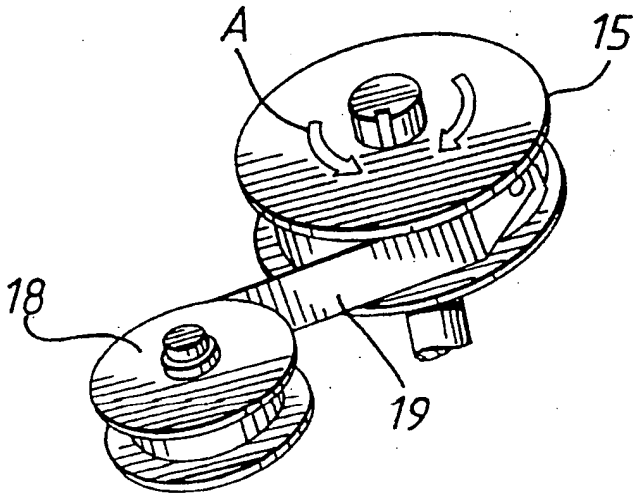
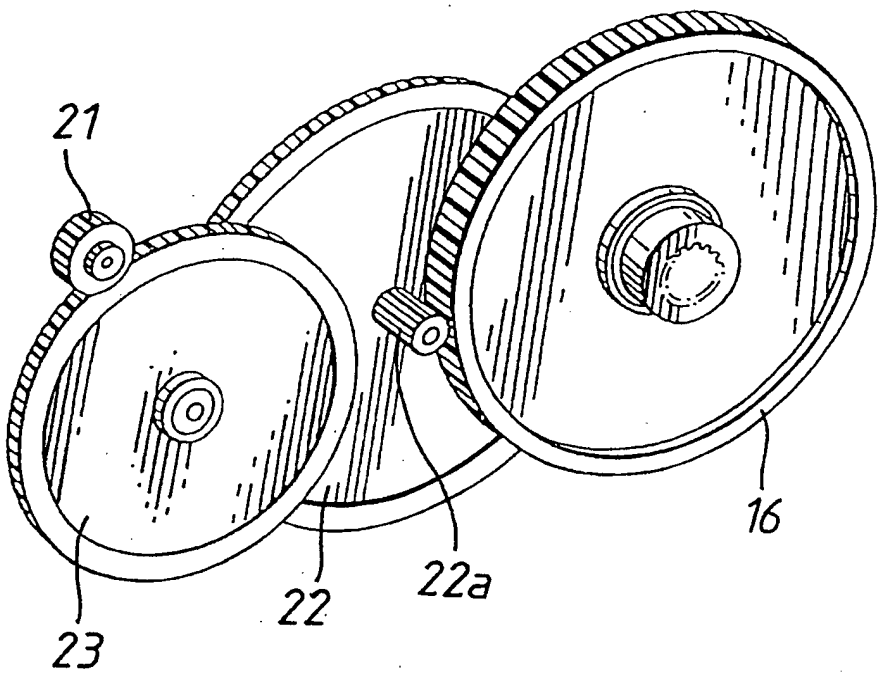


Fig. 7



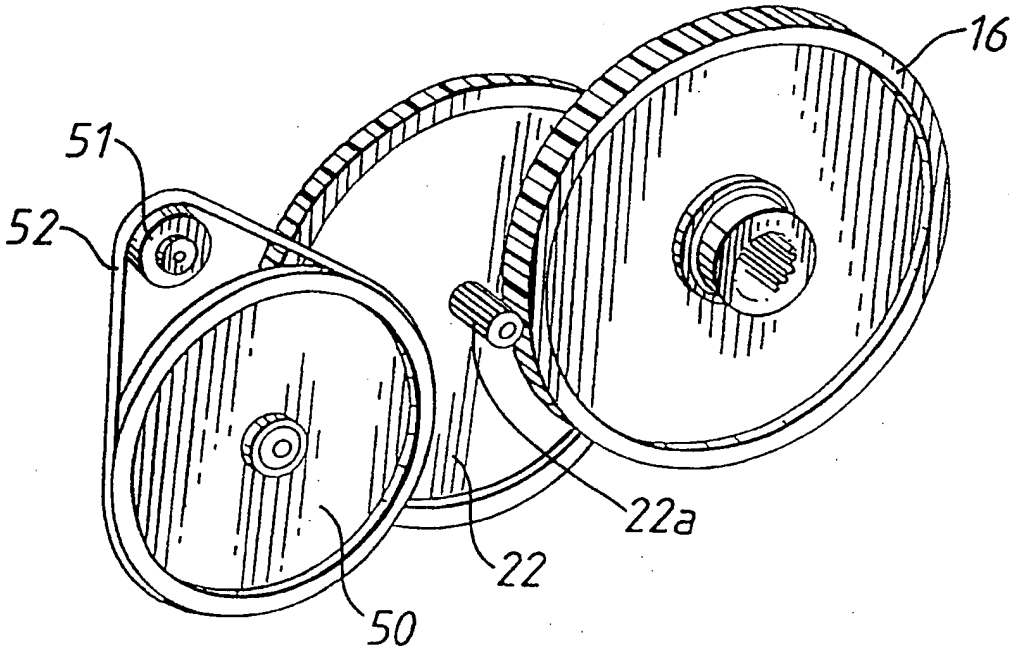


Fig. 8

INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/GB 00/03298

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F21L13/06 F21L4/08 F21L4/02 H02K7/18 //F21W111:10, F21Y101:02,F21Y113:02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F21L H02K F21K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 332 268 A (BAYGEN POWER IND LIMITED ;FREEPLAY ENERGY HOLDINGS LIMIT (GB)) 16 June 1999 (1999-06-16) page 1, line 1 - line 5 page 2, line 21 -page 3, line 4 page 4, line 5 -page 5, line 19 page 8, line 13 -page 10, line 6 page 10, line 17 -page 11, line 26 figures 1,3,5,6,12 ---	1,5,10, 19
A	US 4 360 860 A (JOHNSON HUGH G ET AL) 23 November 1982 (1982-11-23) column 5, line 16 - line 42 column 8, line 4 - line 18 figures 1,2,7 --- -/--	1

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 December 2000	11/12/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040. Tx. 31 651 epo nl. Fax: (+31-70) 340-3016	Cosnard, D

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INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/GB 00/03298

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 552 973 A (HSU CHIH-HSIEN) 3 September 1996 (1996-09-03) the whole document	1

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INTERNATIONAL SEARCH REPORT

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